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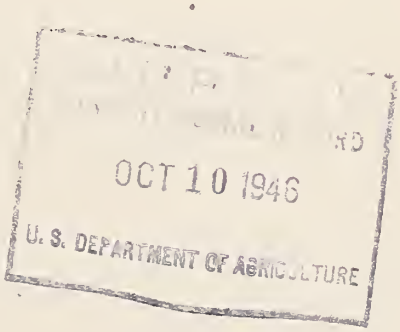
HAY HARVESTING METHODS
Southeastern Nebraska, 1945



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HAY HARVESTING IN SOUTHEASTERN NEBRASKA, 1945

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Summary

(1) This report centers around three methods of harvesting hay: loose, baled, and field-chopped.

(2) The modal size of crew per farm was 6 men for loose long hay, 8 men for baled, and 4 men for field-chopped hay. The smaller crews are easier to assemble and the decrease in strenuous work may attract men to work on farms using choppers.

(3) In a 10-hour day the baler and chopper crews each stored on the average 25 tons of hay from the windrow while only 17 tons were stored per crew by the loose long hay crews. This saving of time in storing hay is important in this area where hay is frequently damaged by rain.

(4) Although hay was put into storage at equal rates per crew for balers and choppers, the chopping method used only half as many men per crew. Labor requirements per ton from windrow to storage were: 3.4 man-hours for loose long hay; 3.5 man-hours for baled hay; and 1.4 man-hours for field-chopped hay.

(5) In 1945 the costs per ton for placing hay in storage from the windrow were: $3.52 for loose long hay, $3.77 for baled hay, and $2.89 for field-chopped hay. When choppers were used, equipment costs were about 14 percent of total harvesting costs, compared with 17 percent for loose long hay and 13 percent for baled hay. Equipment costs per ton vary with the tonnage handled per machine. As the tonnage of hay chopped per machine increases, the total cost per ton declines appreciably and the advantage of chopping compared with handling loose long hay increases.

(6) The investments for haying equipment - hay loaders, baler, chopper, blower, running gears, racks, forks, rope, and boxes - were: $183 for loose long hay equipment; $957 for baled-hay equipment; and $926 for field-chopped hay equipment. The approximate cost new (average of price quotations of several machinery companies, F.O.B. factory) for these same items of equipment were: $411, $1,196, and $1,048, respectively. The farmers interviewed tended to own loose-and baled-hay equipment individually, but shared in the ownership of chopper equipment.

1/ Other members of the Bureau of Agricultural Economics gave suggestions and criticisms.

(7) The hard, strenuous work of haying, particularly that of storing hay back in the hay loft, was eliminated by the use of the chopper method. Farmers consider this a big advantage.

(8) In the opinion of farmers chopped hay kept as well as loose or baled hay, but the chopped hay was cured longer in the field.

(9) Farmers indicated that there was less waste in feeding chopped hay than in feeding loose long or baled hay. In the opinion of farmers feeding chopped hay it seemed to "go further" than loose hay in feeding livestock.

(10) More information is needed on keeping quality and relative feed value of chopped hay.

Introduction

Ever since the tractor began to replace horses as a major source of farm power, new machines and tools have appeared on the market to increase the use of the tractor and to ease the strenuous work associated with farming. The combine-harvester replaced the header and thresher in the wheat area, corn pickers are replacing hand picking of corn, and now new improvements in hay-making attachments are easing the big farm job of haying.

The items of man hours, cash costs, or the time required for haying are relatively easy items to measure and can be compared for different systems or methods. But individual farmers can go beyond the measurable factors to determine whether newer methods should be employed. Included among these factors are the effect of mechanization upon the speed of hay-making operations, timeliness of performance of the various jobs, reduction in size of crew required, and reduction in the proportion of labor which must be hired. Important also is elimination of "heavy" work, such as hand pitching of hay in the field and hand labor in the hay mow. The effect of mechanization upon the quality and feed value of the hay must also be considered.

The reduction of strenuous labor in putting up hay may be of less value to one farmer than to another, and the reduction in size of crew may mean less to farmers who have adequate family labor. In a more arid area or where haying does not interfere with other farm jobs the timeliness or speed of putting up hay is less important. But even here there is risk of damage from rain and the speed with which hay can be put into storage counts. As time goes by it will be possible to tell how fast new methods have been adopted and what effect, if any, they had on the acreage of hay or on farm organization. In this report an attempt has been made to throw light on some of the measurable factors and thereby provide farmers a better basis on which to formulate decisions with regard to adopting improved haying equipment.

Objectives

The study from which this report resulted is a segment of a national project. The primary purpose of this project is to study the methods - both new and old - used by farmers in harvesting and curing hay to determine (1) the relationships between the principal methods of haymaking and efficiency in terms of investment in equipment, cash outlay, time required to complete the job, use of family labor, quality of hay, etc., and (2) the changes farmers are planning to make in their haying practices and equipment as a result of their experiences and recent developments in haying machines and mechanical power.

This report describes three methods used in putting up hay in southeastern Nebraska and compares the three from the viewpoint of relative costs, labor inputs, investment, and time required for haying.

Procedure

As a part of the Nation-wide hay study a reconnaissance survey was made of northeastern Kansas, eastern Nebraska, and southeastern South Dakota in June of 1945. Farmers, machinery dealers, and others who work with farmers and agriculture were contacted to determine the predominant haying practices used in handling alfalfa hay.

After considering the methods of haying in various parts of this area, Richardson County in southeastern Nebraska was selected as a typical area for a detailed study of nonirrigated alfalfa hay. A random sample of farmers was selected from the county assessors' records. When an adequate sample had been obtained of the more common haying methods in all parts of the county, special effort was made to obtain data from all farmers using field pick-up choppers.

Sixty farmers were interviewed and schedules were taken as to equipment used in haying, number of people who worked in the haying operations, hours devoted to various haying jobs, and machinery and labor costs. The details of haying operations were confined to one hay field per farm.

In summarizing these farm schedules the fields were tabulated on a "per cutting" basis because some farmers did not use the same method on all cuttings. The following methods of haying were considered: Loose long hay stored in the barn, baled hay using nonautomatic pick-up balers, and field-chopped hay using a field pick-up chopper and a blower.

Farm Organization

The farms on which the study was conducted were typical of southeastern Nebraska. The major enterprises were corn, beef, and pork

production. The average acres of crops and numbers of livestock are shown in table 1. All of the farms had alfalfa. They ranged in size from 153 to 920 acres. Approximately 56 percent of the land in these farms was owned by the operator. One-third of the farmers were full owners, one-third part owners, and one-third tenants.

Table 1.- Farm organization, average of 60 farmers, southeastern Nebraska, 1945

Kind of crops	Acres	Class of Livestock	Numbers
Alfalfa (all)	28	Horses and mules	4
Corn	102	Milk cows	9
Wheat	29	Beef cows	5
Oats	32	Feeder cattle	47
Red clover	7	Other cattle	11
Miscellaneous crops	7	1944 fall pigs	11
Idle cropland	8	1945 spring pigs	44
Rotation pasture	7	Feeder pigs bought	34
Permanent pasture	52	Hens and pullets	153
Other land	36		
Total acres	308		

Mowing and Raking

In each of the three methods of storing hay, the hay was cut and windrowed. The time required to mow and rake was dependent on the type of power. On the 30 farms using tractor power for mowing three times, as much hay was cut per hour as on farms using horse-drawn mowers (table 2). The difference in performance was due to the faster speed at which tractor mowers operated and the longer sickle bar. Substitution of the tractor mower for the horse-drawn mower is one of the most outstanding examples of the advantages of mechanization in haymaking.

A few farmers who used tractor mowers had attachments to windrow the hay as it was mowed. This saved one operation and did not materially reduce the rate per hour for mowing.

Side-delivery rakes showed less advantage for the tractor-drawn rakes, with 3.2 acres per hour as compared to horse-drawn rakes with 2 acres per hour. In general the farmers with both horse and tractor power tended to use horses for raking and tractors for mowing.

Table 2.- Comparison of tractor and horse power for mowing and raking hay in southeastern Nebraska, 1945

Type of power	Tractor	Horse
Mowing:		
Number of farms 1/	30	16
Tons of hay per acre cut	1.2	1.0
Length of sickle bar	7 ft.	5.5 ft.
Acres mowed per hour	3.1	1.0
Raking with side-delivery rake: 1/		
Number of farms	28	15
Tons of hay per acre raked	1.3	1.2
Size of rake	10 ft.	10 ft.
Acres raked per hour	2/ 3.2	2.0

1/ The only farms included in this table were those using one type of power for mowing and for raking and using common sizes of machines.
2/ Many of these farmers used side-delivery rakes that were too light (horse-drawn type of rake) to handle the hay at the optimum speed of the tractor, therefore those farmers had to reduce the speed of their tractors or rake less than a full swath.

Storing Hay - Description of Methods

Loose long hay stored in the barn.- A common method of storing hay in this area was loose in the barn. In 1944, 88.6 percent of all hay in Nebraska was harvested as loose long hay 3/. The farmers who employed this method used hay loaders which were commonly pulled by tractors to load the hay from the windrow into the wagon and hay forks to unload at the barn.

Baled hay stored in the barn.- Baling hay by the use of a medium size pick-up nonautomatic baler was the second most common method found in this area. For the State of Nebraska 10.7 percent of the 1944 hay crop was baled at harvest time 4/. The baler used on most farms was medium size with a windrow pick-up. The balers all had auxiliary engines and were tractor-drawn. The bales were handled in different ways. Some dropped from the baler to the ground and were thus scattered over the field, some were dropped onto sleds and left in piles of 8 to 10 bales, and others were taken directly from the baler onto trailer racks towed behind the baler.

Baled hay was unloaded at the barn by three different methods. The more common method was to unload by using hay forks the same as with loose hay. The other methods were putting bales in the mow by hand and by the use of elevators. The few elevators used in haying were corn elevators adapted to handle baled hay.

3/and 4/Harvesting the Hay Crop, by A. P. Brodell, T. O. Engebretson, and Charles G. Carpenter, RM 57, Bur. Agr. Econ. See p. 14.

Field-chopped hay stored in the barn.- Field chopping of hay was the newest method of haying found in this area. Its relative newness in Nebraska is indicated by the fact that only 0.7 percent of the 1944 hay crop was harvested by field choppers 5/. These field choppers were rated to handle 3 to 5 tons of dry hay per hour. They were pulled down the windrow by tractors and operated by power take-off.

Chopped hay from the field chopper was blown into wagon or trailer boxes; and then hauled to the barn. These boxes were pulled beside the field chopper by an extra tractor or were towed behind the chopper. The chopper spout was adjustable so as to deliver chopped hay either to the side or behind the chopper. Most of the boxes were partially covered with canvas to reduce the loss of hay as it was blown from the chopper.

Chopped hay was unloaded into a stationary blower at the barn and blown into the haymow. Unloading of the box was accomplished by pushing the chopped hay out of the box into the auger of the blower. Some of the boxes unloaded from the end and some from the side. Two boxes were fixed with a canvas on the bottom and by rolling this canvas onto a rod attached to the rear of the box the chopped hay was moved back and dropped into the blower auger. Most of the farmers were thinking of making boxes with some arrangement on the floor which could be rolled, thereby easing the unloading job. The blower auger fed the chopped hay into the blower which in turn blew it into the desired part of the mow.

Comparison of Haying Methods

Hay curing in the field.- The stage of maturity when cut and the length of time hay was cured in the swath and windrow varied with the method of harvesting (table 3).

Hay to be chopped tended to have a higher percentage in full bloom. As an average, it was cured in the swath and windrow nearly 50 percent longer than was loose long hay, but only 12 percent longer than hay to be baled. Because of this wait for drier hay the percentage of hay damaged by rain was greater. This was particularly evident during the first cutting in June when rains were more frequent. The degree of damage from rain was not defined, but it appeared to be minor because very little hay spoiled and the quality of hay was reported "good" to "excellent" by the farmers.

Size of crew and labor force.- The number of men needed to make a haying crew varied considerably, but tended to be largest for the non-automatic balers. The number of men in a baling crew varied from 5 to 10 on the 32 farms that baled at least one cutting. However, the crews for baling generally consisted of 8 men - one driving the tractor to pull the baler, two tying bales on the baler, three men loading and hauling, and two men at the barn to help unload and arrange the bales in the mow.

5/ See footnote, page 5.

Table 3.- Hay-curing practices compared by cuttings for three hay-harvesting methods, southeastern Nebraska, 1945

Item	Loose hay	Baled	Chopped
First cutting:			
Number of farms	30	17	13
Percentage in full bloom when cut	88	77	88
Average time elapsed between:			
Cutting and raking, hours	28	21	40
Raking and processing, hours	20	42	35
Percentage of hay damaged by rain	16	19	35
Second cutting:			
Number of farms 1/	20	25	14
Percentage in full bloom when cut	64	78	84
Average time elapsed between:			
Cutting and raking, hours	20	28	30
Raking and processing, hours	18	26	20
Percentage of hay damaged by rain	1	12	13
Third cutting:			
Number of farms 2/	22	19	13
Percentage in full bloom when cut	37	41	50
Average time elapsed between:			
Cutting and raking, hours	19	21	25
Raking and processing, hours	17	27	26
Percentage of hay damaged by rain	0	0	0

1/ One farmer let the alfalfa go to seed.
2/ Two farmers harvested seed crops, two didn't cut, one sold the alfalfa, and one pastured.

The smallest crews were used in putting up hay with the field chopper. These crews ranged from two to five men on the 14 farms having field-chopped hay. The modal size of crew was four; one to drive the tractor and operate the chopper, two to haul chopped hay to the barn and one to operate the blower. In some cases only one man hauled and the crew was reduced to three.

The size of crew varied most on farms where hay was put up loose. On the 37 farms reporting this method, the size of crew varied from 3 to 9, the most usual being 6. The workers and jobs were: one on tractor pulling wagon and loader, two handling hay on the wagon, one man hauling and two men at the barn to help unload and store the hay away in the mow.

Of all the workers employed in haying on these 60 farms, 31 percent were neighbors working on an exchange basis, 39 percent were hired workers, 14 percent were farm operators working on their own farms, and 16 percent were unpaid family workers. The greatest amount of this family labor was available from boys, although other members of the family helped out during this year of labor shortage.

There was a tendency toward the use of more exchange workers and less family and hired workers as the haying method became more mechanical (table 4). As a result of cooperative ownership of haying equipment, exchange workers were used most and family and hired workers were used least on farms using field choppers.

Table 4.- Composition 1/ of labor force by methods of haying, southeastern Nebraska, 1945

Source of workers	Loose hay	Baled hay	Chopped hay
	Percent	Percent	Percent
Operator	21	16	28
Unpaid family labor	30	19	3
Hired labor	33	23	7
Custom labor	0	17	0
Exchange labor	16	25	62

1/ Based on number of workers reported in haying crews and does not necessarily indicate amount of work performed.

Labor requirements.- In taking hay from windrow into storage the field-chopping method required less than half the man labor used by the other two methods (table 5). Specifically the chopping method required only 1.4 man-hours while baled hay required 3.4 man-hours and loose long hay required 3.5 man-hours per ton.

On a crew basis the rate of putting up hay was the same for choppers and balers. The modal size crews who worked 10-hour days put up 17 tons of loose long hay while the baler and chopper crews each put up 25 tons. The increased speed with which chopped and baled hay can be put into storage does not fully offset the longer curing period required, but it is important in this area where considerable hay is damaged each year by rain.

Cost of processing and storing hay.- The cost of processing (baling and chopping) and storing a ton of hay by the different methods is shown in table 6. Labor costs were figured at $0.65 per hour, the general wage paid to hay hands in 1945. Wages were included for the farm operator and for family labor as well as for hired labor. Labor costs were an actual cash expense for only one-third of the labor

Table 5.- Labor requirements in processing (chopping and baling) and in moving hay from windrow to storage by three hay-harvesting methods, southeastern Nebraska, 1945

Item	Loose hay	Baled hay	Chopped hay
Number of field cuttings 1/	110	121	37
Acres of hay per field cutting	14	15	11
Tons of hay stored per field cutting	16	18	15
Average miles to storage	0.5	0.6	0.3
Modal crew, number of men	6	8	4
Crew hours per ton	0.6	0.4	0.4
Man-hours per ton	3.5	3.4	1.4
Tons per crew for 10-hour day	17	25	25

1/ Number of fields times number of cuttings; thus a farmer with two fields and three cuttings in each field was counted as six.

Table 6.- Average cost per ton to process (bale and chop) and move hay from windrow to storage by three haying methods on 53 farms in southeastern Nebraska, 1945 1/

Item	Loose	Baled	Chopped
Number of farmers reporting each method 2/	36	33	9
Labor costs (@ $0.65 per hour)	$ 2.26	$ 2.19	$ 0.89
Machinery repair:			
Loader	.13		
Baler, medium, nonautomatic pick-up		.21	
Chopper and blower, medium			.09
Fuel costs for auxiliary engine		.37	
Tractor costs (@ $0.50 per hour) 3/	.39	.45	.63
Horses (@ $0.12 per hour)	.12	.07	.00
Depreciation 4/	.41	.34	.89
Interest on investment (@ 5%) 4/	.19	.14	.39
Cost per ton of hay	$ 3.52	$ 3.77	$ 2.89

1/ Seven farms omitted because their equipment was not comparable to the others.

2/ Twenty-five farmers put up part of their hay loose and part baled. (Therefore they were counted twice.)

3/ Tractor costs were derived from University of Nebraska Experiment Station Bulletin No. 324. They include depreciation and interest.

4/ The depreciation and interest were calculated from present values of 34 hay loaders, 7 pick-up nonautomatic balers and 5 medium pick-up field choppers and blowers.

force where hay was stored as loose long hay; two-fifths the labor force with baled hay and one-fourteenth the labor force with the field-chopped method. The remainder of the labor force was family, operator, and exchange labor. However, wages were calculated for all labor in order to derive comparable costs between methods of haying. Repair and fuel costs for auxiliary engines were based on actual costs as reported by the operators.

At 1945 rates the cost per ton for labor was $2.28 for loose long hay, $2.19 for nonautomatic pick-up baled hay and $0.89 for field-chopped hay. This indicates a saving in labor costs of $1.39 in chopping and storing hay as compared with the storing of loose long hay and $1.30 as compared with baling and storing baled hay. If automatic pick-up balers were used the labor costs for baling would be lower.

Repairs and fuel costs were lowest for putting up loose long hay. They averaged $0.64 per ton for loose long hay, $0.72 for chopped hay, and $1.10 per ton for nonautomatic baled hay. This difference in cost between the chopper and baler was approximately equal to the cost of operating the auxiliary engines. The repair costs on the chopper and blower were the average for five relatively new choppers. Doubtless repair costs will increase as the machines become older and worn. The depreciation costs were based on farmers' estimates of the expected life of each machine and prorated on the basis of tonnage handled.

Total haying costs per ton of hay (other than mowing and raking costs) for the different methods were $3.52 for loose long hay, $3.77 for baled hay, and $2.89 for field-chopped hay. The items of cost show that repair and fuel cost were least with the loose long hay method, but labor costs were the greatest by this method. The chopped method had the lowest labor costs per ton with the largest depreciation costs. The baler was the most expensive method of haying, but hay was moved to storage as fast by baling as by chopping. With the change to automatic balers which many farmers are now planning, the spread in costs between baling and chopping will be less.

Investment in hay-harvesting equipment.- To reduce the time spent and the strenuous work of haying by replacing manual labor with machines means an investment in more expensive machinery and equipment. The list of equipment needed for each of the three methods, but not common to all these methods of haying is shown in table 7. The prices listed under "approximate cost new" are shown to give a comparison between the total investment in specialized new machinery under the different methods of haymaking.

Baler equipment on hand was valued at $774 more than the equipment for loose long hay. The difference in approximate cost new was $785. This additional investment in baler equipment enabled these farmers to put up the same amount of hay in two-thirds of the time, although the cost per ton was $0.25 greater.

Table 7.- Methods and equipment used to handle hay, southeastern Nebraska, 1945
(Items common to all methods omitted)

Method and equipment	Machines needed to put up hay at a given time: Number	Machines needed to put up hay at a given time: Approximate cost new 1/	Machines studied in 1945: Number	Machines studied in 1945: Average age	Machines studied in 1945: Average value in 1945	Average use per machine
Loose hay:		Dollars		Years	Dol.	Tons
Loader	1	160	34	8	84	90
Running gears and racks	2	218	45	9	80	
Hay fork	1	14	33	6	10	
Rope (190 feet av. length)	1	19	33	4	9	
Total		411			183	
Baled hay:						
Baler, nonautomatic pick-up	1	945	7	1	840	1137
Running gears and racks	2	218	33	8	98	
Hay fork	1	14	33	6	10	
Rope (190 ft. av. length)	1	19	33	4	9	
Total		1,196			957	
Chopped hay:						
Field chopper (medium size)	1	558	5	1	534	167
Running gears and box	2	240	9	5	142	
Blower	1	250	5	new	250	
Total		1,048			926	

1/ FOB factory prices. An average of quotations from several implement companies.

Compared with loose long hay equipment, the additional investment for chopper equipment was $743 based on 1945 machine values, but on the basis of new machine values it was $637 6/. In return for this additional cost of chopper equipment farmers were able to put up a ton

6/ The smaller spread between new costs as compared to present value was a result of relatively new chopper equipment.

of chopped hay in two-thirds the time required by the loose long hay method and the hay crew was reduced by two men. There was a net labor saving of $1.39 a ton.

The nonautomatic baler equipment was valued at $31 more than chopper equipment in 1945 and the approximate cost new was $148 greater. With the lower cost for chopper equipment farmers were able to put up hay just as fast with only half the crew. In addition the total costs per ton harvested were lower and a larger part of the strenuous work was eliminated.

An indication of what these 60 farmers think of the newer methods was indicated by the machinery they intend to buy. Ten percent plan to buy automatic pick-up balers and another 10 percent plan to buy field pick-up hay choppers. None of these farmers plan to buy nonautomatic pick-up balers and only 3 percent plan to buy hay loaders.

Time required to pay for chopper by savings in labor.- The field pick-up chopper and the blower are new machines and there is little experience to indicate their probable life. It is therefore impossible to develop a reliable depreciation estimate for these machines at the present time. In view of this difficulty it may be worth while to consider the time required to pay for the additional investment in these machines through the savings in man labor which accrue from chopping hay compared with storing loose long hay in the barn (table 8).

If the farmer were haying by the loose long hay method and desired to change to the field-chopped method, he would need to buy a field chopper and blower at a cost of $808. He would need to replace the racks with boxes in which to haul chopped hay. These boxes would cost about $51 each or a total of $102. He could use the same running gears. Altogether the difference between the cost of new chopper equipment and what he can use of his loose long hay equipment would amount to $910. The difference in haying costs with a given price for man labor, multiplied by the number of tons of hay he planned to chop each year, less 5 percent interest on half the cash outlay, divided into $910, gives the number of years required for savings in labor costs to equal the additional costs for chopper equipment.

For example, if a farmer haying by the loose long hay method wanted to buy a field chopper and blower he should consider how much hay would be chopped each year and estimate the cost of labor for the next few years. Suppose this farmer plans to chop 120 tons of hay a year and that labor will cost $0.50 per hour - then 10 years would be required to pay the cost of additional chopping equipment. Various combinations are shown in this table by using different tonnages and wage rates so that farmers can estimate how long the choppers and blowers must be used to compensate for additional costs over the loose hay method.

Table 8.- Number of years required for savings in labor cost (by the chopping method compared with the loose hay method) to equal the additional investment in equipment needed in changing to the chopping method 1/

Tons of hay chopped per year	Costs per hour for man labor								
	$0.25	$0.30	$0.35	$0.40	$0.45	$0.50	$0.55	$0.65	$0.75
60	---	---	---	40	32	26	22	17	14
80	---	---	30	24	20	16	14	11	9
100	---	28	21	17	14	12	11	9	7
120	30	21	16	13	11	10	9	7	6
140	23	17	13	11	9	8	7	6	5
160	19	14	11	9	8	7	6	5	4
180	16	12	9	8	7	6	5	4	4
200	14	10	8	7	6	5	5	4	3
220	12	9	7	6	5	5	4	4	3

1/ Formula used: $\frac{V}{Z(BX - A) - Y}$

V = $910 - that is the $1,048 for chopper equipment less the new cost of 2 running gears, table 6.
Z = Tons of hay chopped each year, table 7.
B = 2.1 which is the hours of labor saved per ton between the two methods of haying, table 4.
X = Cost of man labor per hour, table 7.
A = $0.08, the difference in machinery repair and power costs per ton based on 34 loaders and 5 choppers, table 5.
Y = $22.75, interest on half of $910 @ 5 percent.

A person just starting to farm and who does not own any equipment would have a choice of buying loose hay equipment or chopped-hay equipment at new machinery values. In order to indicate the length of time required for savings in labor costs to equal the difference in investment of the two methods, table 9 is presented. This table follows the same procedure as table 8 but the additional cash outlay would be only the difference between the two sets of equipment, or $637.

With man labor at 50 cents per hour and 120 tons of hay chopped yearly, it would take 6 years for the savings in labor costs to pay the additional capital costs required for the chopping method. It should be remembered that the number of years was determined for labor savings to cover only the additional capital costs and not the total cost of the field-chopper equipment.

Table 9.- Number of years required for the savings in labor costs by the chopping method compared with the loose-hay method to equal the difference between the new cost of the equipment needed for these two methods 1/

Tons of hay chopped per year	Costs per hour for man labor								
	$0.25	$0.30	$0.35	$0.40	$0.45	$0.50	$0.55	$0.65	$0.75
60	61	37	27	21	18	15	13	10	9
80	35	23	17	14	12	10	9	7	6
100	23	16	13	11	9	8	7	6	5
120	17	13	10	8	7	6	6	5	4
140	14	10	8	7	6	5	5	4	3
160	12	9	7	6	5	5	4	3	3
180	10	8	6	5	5	4	4	3	2
200	9	7	5	5	4	4	3	3	2
220	8	6	5	4	4	3	3	2	2

1/ Formula used: $\frac{V}{Z(BX - A) - Y}$

V = $637 - that is, $1,048 minus $411, from table 6.
Z = Tons of hay chopped each year, table 8.
B = 2.1 which is the hours of labor saved per ton between the two methods, table 4.
X = Cost of man labor per hour, table 8.
A = $0.08 - the difference in machinery repair and power costs per ton based on 34 loaders and 5 choppers, table 5.
Y = $15.90, interest on half of $637 @ 5 percent.

Farmers who do not have sufficient hay of their own to justify the investment in a hay chopper can acquire many of the advantages of the chopper through joint ownership, through custom hiring, or through the purchase of a chopper and its use for custom work. The latter may be of particular interest to those operators who have a regular labor force available for custom work during slack periods on the home farm.

The few farmers doing custom work with choppers in 1945 charged an average of $3.00 per ton of hay chopped. Most of them furnished the chopper, the tractor to pull it, two racks and running gears, and the services of two men. Cash costs, other than cash labor costs incurred by these operators averaged little more than 20 cents a ton, 9 cents for chopper repairs, and 11 cents for repairs, fuel oil, and grease used by the tractor.

Accordingly, an operator with the equipment and a regular labor force available for such operations would have a return above cash expenses of $2.60 to $2.70 a ton, even if the cost of chopper repairs

were two or three times the abnormally low costs incurred in 1945. At these rates, the custom chopping of about 300 tons of hay would return an initial investment of $800 in the chopper and the two racks and running gears. The chopping of about 95 additional tons would return an initial investment of $250 in a blower. If the operator had to hire two men for such work, the custom chopping of more than 400 tons probably would be required to return the initial investment in chopper, running gears and racks, and more than 525 tons to return the investment in chopper, running gears, racks, and blower.

Prospects in southeastern Nebraska for paying for chopping equipment through custom work are favorable generally, as these estimates would indicate. In using the estimates, however, further considerations should be kept in mind. For instance, custom work would depreciate the value of the equipment and these estimates make no allowance for depreciation or for the other noncash costs of operation. They are based on the operation of a few relatively new machines, continued operation of which may incur higher costs. Operators in southeastern Nebraska who contemplate the financing of chopping equipment through custom work should consider too the relatively short periods during which field chopping is feasible. The chopping of hay from the stack, as is done in some areas, could lengthen the chopping season, but it would involve additional costs (for stacking) and inconvenience for the farm operator.

General considerations.- Farmers were asked various questions relating to haying, storage, and handling of hay on their farms. These are their replies as to haying methods with which they are familiar:

(1) As compared to loose long hay, baling decreased the strenuous work of haying and field chopping eliminated nearly all of it, particularly the hot strenuous job of working in the mow.

(2) Labor was easier to obtain for the chopping method because the work was less strenuous than for other methods and a smaller crew was needed.

(3) Though some damage was reported on chopped hay, there was no apparent loss in feeding value.

(4) Farmers using the field chopper said their hay kept as well as loose or baled hay if placed in storage under the same conditions. They cautioned against walking on fresh hay blown into storage as it tended to mold wherever it was packed by walking.

(5) Baled and chopped hay were easier to remove from storage for feeding than was loose long hay.

(6) Farmers thought that field-chopped hay had appreciably more feeding value than baled or loose long hay. This increased feeding value was attributed to less waste because cattle could not pull chopped hay from the bunks or eat the fine stems and leave coarse stems as was the case with loose long hay.